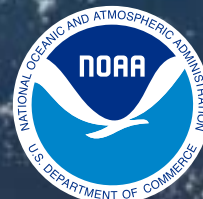


WEATHER PROGRAM OFFICE **STRATEGIC PLAN**

Fiscal Years 2022–2026

The Weather Program Office is situated within the Office of Oceanic and Atmospheric Research of the National Oceanic and Administration under the Department of Commerce.



NOAA
WEATHER
PROGRAM OFFICE

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LETTER FROM THE DIRECTOR



Over the past decade, the National Oceanic and Atmospheric Administration's (NOAA) Weather Program Office (WPO) has grown and evolved in budget and staff by an order of magnitude. This is in part because weather research challenges have similarly expanded. First, climate change has caused an increase in the frequency and severity of extreme weather and water events, such as deadly fires, floods, drought, extreme heat, and coastal surge. Second, populations continue to expand in severe weather-prone areas, and vulnerable communities in these areas have a difficult time preparing for, and responding to, extreme events. Despite improvements in forecast skill, NOAA still lags in its ability to effectively communicate forecasts and achieve its desired outcome of reducing loss of life and property. Third, the demand for weather information continues to grow across all sectors of the economy.

Decision makers want to know how oceans, smoke, sea-ice, and the biosphere influence the atmosphere and affect forecast skill. They also want more accurate weather forecasts at lead times from days to months, when the decision space is greatest. To provide this information, we must widen our perspective to include the entire Earth system; this includes using a seamless weather-to-climate research and development approach to improve forecasts. These challenges are immense and far outsize the resources of a single program office. Therefore, our strategy begins with the goal of acting as a catalyst to rally partnerships inside and outside of NOAA and fostering teams suited for the need. Meeting these weather challenges requires all hands on deck, including Oceanic and Atmospheric Research (OAR) Laboratories, other Program Offices in OAR, National Weather Service (NWS) Programs and Centers, and other national and international government agencies, academia, and industry partners. At the core of this endeavor is the WPO staff, and we take immense pride in our diversity, skills, and collaborative philosophy. These qualities and values are key to building the community needed to meet the challenges of the coming decade. This document is written as a five-year plan, but many of these goals and objectives may still be relevant a decade or more from now.

While WPO continues to play a key role in delivering forecast advances to improve operational services, it is also imperative that we foster exploration of novel and innovative approaches to understand and solve weather science and prediction challenges of the future. The research funded by WPO must increasingly challenge the Weather Enterprise towards creative, advanced technologies and out-of-the-box exploration of novel solutions.

With that, I thank you for your interest in WPO's new 2022–2026 Strategic Plan, and we look forward to your collaborative contributions to its successful outcomes!

GUIDING PRINCIPLES

Innovative Science Powering a Weather-Ready Nation

-WPO Strategic Vision

OUR MISSION

Cultivating, funding, and transitioning collaborative weather research that results in accurate and actionable weather information *for all.*

CORE VALUES

Integrity: We adhere to the highest scientific, personal, and professional standards.

Inclusive Innovation: We welcome a wide diversity of experiences, knowledge, and ideas to drive open-science solutions.

Teamwork: We value collaborative approaches and transparent communications across WPO and with our partners.

Social Stewardship: Everything we do is geared towards benefiting society.

Results-Driven: We achieve measurable, high-quality research outcomes to advance the NOAA mission.

UNIQUE VALUE PROPOSITION

Honest Broker, Coordinator, Facilitator

WPO is well positioned to be the honest broker among OAR Laboratories and with the National Weather Service. Coordinating joint projects/programs, facilitating discussions on weather research priorities between OAR and NWS, and fostering communication/information flow of operational requirements from NWS and future research avenues from OAR will increase alignment across line offices and benefit NOAA as a whole.

Weather Enterprise Partner

WPO is in a unique position to build partnerships and relationships with the Weather Enterprise to advance large research challenges. WPO can help leverage the expertise within academia and industry to address NOAA's future science and service needs through agreements and funding opportunities. WPO can help foster systematic, collaborative exploration of future research needs and directions between decision makers, academia, industry, and NOAA.

Innovation Leader

WPO is also well positioned to lead innovation for NOAA. WPO can promote innovation by funding longer-term, high-risk/high-reward approaches, encouraging experimentation, and engaging non-traditional partners. Additionally, WPO can use its external funding opportunities and open science platforms as mechanisms to seek innovative solutions to NOAA's biggest weather research topics.

Social Science Hub

WPO has expertise and experience as a social science leader in the agency and is well positioned to champion NOAA's understanding of human

behavior before, during, and after extreme weather and water events. WPO will continue to provide cutting-edge social science data analysis and research to inform future changes to operations, products, and decision support services, with the goal of more equitable outcomes across demographics and geographies.

Center for Open Science & Development in Earth System Modeling

Through the Earth Prediction Innovation Center (EPIC), WPO is poised to advance modeling using a more holistic Earth systems modeling approach, collaborative community-based open development of Unified Forecast System (UFS) applications and data assimilation techniques, and ocean, atmospheric composition, and ecosystem observations/components on time scales from minutes to months and on spatial scales from kilometers to the globe.

Experience with Research Transitions

Key to WPO's mission is to effectively transition research to operations and applications. WPO has led the way in OAR over the last 5+ years in the development of transition processes and in achieving results. WPO will continue to build relationships across OAR Laboratories, academia, industry, other federal agencies, and NWS to streamline research transitions and will increase our analysis capabilities to track research projects from their initialization to the ultimate products, services, or knowledge developed from those projects.

INTRODUCTION

The Weather Program Office's (WPO) strategic goals for 2022–2026 reflect our commitment to lead, fund, and collaborate on strategic weather research to advance scientific knowledge and its applications. WPO will foster collaborations within the National Oceanic and Atmospheric Administration (NOAA) and throughout the Weather Enterprise to improve our understanding of the Earth system and transition research to actionable information that saves lives, protects property, and enhances the Nation's economy.

WPO's four strategic goals for 2022–2026 are a collection of interdependent research strategies that advance weather information, forecasts, products, and services for NOAA and the Nation. Goals one and four detail the foundational aspects needed to accomplish WPO's mission and vision, including workforce development, funding strategies, and research infrastructure. Goals two and three describe specific forecast and service improvements envisioned across the weather value chain.

Foundational to the achievement of our bold strategic goals and objectives are the multitude of research partners with whom we collaborate. This includes OAR Laboratories and Program Offices, other federal agencies, academia, non-governmental organizations, and industry. Specific areas where WPO intends to build or strengthen these essential partnerships are woven throughout this plan. In particular, we recommit to our strong relationship with the National Weather Service (NWS) to continue to advance operations to research (O2R) and research to operations (R2O) transitions.

WPO leadership interviewed over 50 internal and external stakeholders and evaluated numerous background sources in the development of this plan. The Weather Research Forecasting Innovation Act 2017 and its reauthorization in 2019 continue to serve as foundational legislation for our office and guide our overall strategy. We have also incorporated 25 of the 33 recommendations from the congressionally-requested Priorities for Weather Research (PWR) Report published in December 2021 by the NOAA Science Advisory Board (SAB) into this plan, and we continue to align with the Oceanic and Atmospheric Research's (OAR) Strategic Implementation Plan, which contains a straightforward but complex goal to "Make Forecasts Better."

Thank you for your interest in learning more about our 2022–2026 vision and strategy in NOAA's Weather Program Office. A snapshot of our four strategic goals are below:

STRATEGIC PLAN GOALS TO ADVANCE WEATHER RESEARCH



1 Foster a collaborative weather research and development network with academic, governmental, and industry partners.



2 Improve high-impact weather forecasts, products, and services and their delivery, use and value to the public.



3 Contribute to the best possible Unified Forecast System through a community-based, Earth system modeling approach.



4 Strengthen the mission-enabling foundational infrastructure for next-generation weather research and transitions.

Goal 1: Foster a collaborative weather research and development network with academic, governmental, and industry partners.

The Weather Program Office (WPO) will continue to embrace our role at the nexus of a weather research and development network in the National Oceanic and Atmospheric Administration (NOAA) and the larger Weather Enterprise. This means that WPO will be increasingly intentional about partnership-building across Oceanic and Atmospheric Research (OAR), the National Weather Service (NWS), academia, and industry to advance innovative weather research and to improve future products and services.

The Weather Program Office will engage proactively using open science and open source principles that encourage collaboration and will make our research more accessible to the community at large. Integral to this network is the WPO workforce. The WPO workforce will continue to serve as a model for diversity, equity, inclusion, justice, and accessibility principles, and be trained

and engaged in the skill sets needed for the future. Aligned with the President's Management Agenda (PMA) Learning Agenda, we will explicitly seek out new ideas and perspectives and apply energy to building and sustaining critical partnerships across NOAA and the larger Weather Enterprise.

Weather Research and Development Network

The Weather Research and Development Network is a system of deliberate social mechanisms that leverage academic, governmental, and industrial partners to create, educate, apply, and advance weather information synthesis, models, forecasts, and decision support.

Weather Enterprise

The Weather Enterprise includes all entities in the public, private, nonprofit, research, and academic sectors that provide weather information, forecasts, services, and infrastructure.

Collaborative, Multidisciplinary, Community-Based Research

- 1.1** Support a robust community infrastructure and mechanisms to embrace open science, collaboration, and innovation across the Weather Enterprise.
- 1.2** Use an open source, open data approach for software development and data collection activities funded by WPO.
- 1.3** Create more equitable research outcomes by improving access to WPO funding opportunities for diverse stakeholders, institutions, and recipients.
- 1.4** Apply a multidisciplinary approach to address evolving science and research challenges through joint funding opportunities and co-management structures among WPO programs and other NOAA offices.

COLLABORATION OPPORTUNITIES

Earth Systems Model Development | Social Science Applications & Risk Communication | Research to Operations (R2O) Acceleration | Ocean and Coastal Observations & Forecasts | Infusion of Innovative Research Approaches | Workforce Development

Innovative Research Opportunities

- 1.5** Provide more high-risk/high-reward WPO funding opportunities to promote innovative, cross-disciplinary, transformational projects.
- 1.6** Expand the use of creative funding and collaboration mechanisms with the Weather Enterprise, such as Memoranda of Understanding (MOUs), Cooperative Research and Development Agreements (CRADAs), inter-agency agreements, prize challenges, mini grants, and hackathons.

Targeted Partnerships

- 1.7** Increase collaborations and optimize the unique capabilities of NOAA and Weather Enterprise partners to continuously advance weather research.
 - 1.7.1 NOAA:** Embrace WPO's role as a program office by aligning and coordinating NOAA's weather research laboratories and programs with operational needs and requirements.
 - 1.7.2 Academia:** Strengthen and expand relationships with academic institutions and cooperative institutes to understand future research directions and to explore multi-university research consortia to address critical NOAA science priorities.
 - 1.7.3 Industry:** Strengthen and expand private sector partnerships to explore new and innovative solutions, technologies, and observing platforms.
 - 1.7.4 Government:** Sustain and enhance collaborations with federal, state, and international government agencies to identify collective requirements and optimize cross-disciplinary research and applications.

WORKFORCE MATTERS

A VISION FOR PEOPLE AT THE WEATHER PROGRAM OFFICE



We continue to expand and improve **diversity, equity, inclusion, justice, and accessibility** for WPO staff, funding recipients and partners.



We promote **innovation, collaboration, discovery** and strategic thinking.



We aim to broaden skill sets through **training** and opportunities for **career development**.



We will use **sound management performance approaches** to achieve our mission outcomes and ensure excellence.

WPO Workforce and Organization of the Future

- 1.8** Promote a culture of innovation, collaboration, and trust with allocated time, technology, tools, and opportunities to promote curiosity, discovery, resilience, strategic thinking, and work-life integration within WPO.
- 1.9** Expand efforts to improve diversity, equity, inclusion, justice, and accessibility for WPO employees, partners, and funding recipients.
- 1.10** Broaden the skill sets and perspectives of WPO employees through hiring, training, and development opportunities, and bring new ideas into WPO through detail assignments, staff exchanges, and student programs.
- 1.11** Improve objective evaluation methods of WPO-funded and managed research activities to identify benefits accrued, knowledge gaps, and to more precisely balance future investments across the weather information value chain.
- 1.12** Apply sound performance management approaches to track WPO-funded project accomplishments and to enhance program coordination, organizational excellence, and mission outcomes.

Goal 2: Improve high-impact weather forecasts, products, and services and their delivery, use, and value to the public.

An accurate and timely forecast is only as valuable as its ability to influence decision-making. This strategic goal focuses on improving extreme weather predictions and connecting those improvements to social science research to make those predictions more useful. WPO will work in close partnership with OAR Laboratories, the NWS, and the Weather Enterprise to coordinate and fund research that aims to improve extreme weather forecasts across a variety of phenomena and timescales. This includes severe weather, extreme rainfall, winter weather, subseasonal to seasonal

forecasts, tropical weather, and fire weather and atmospheric composition. As described in this goal, WPO will fund and apply social science to advance risk communication and provide more detailed assessments of user needs, including for underserved or vulnerable communities. Looking towards the future of weather forecasting, WPO will also support demonstrations and evaluations of new products, tools, and decision support services focused on ensemble-based, probabilistic information informed by social science research.

Social Science Research for User Needs and Risk Communication

- 2.1** Improve understanding of user and forecaster needs and facilitate the co-development of new products and services using human-centered design principles.
- 2.2** Prioritize interdisciplinary and trans-disciplinary research concerning the equitable and effective use of hazardous weather information for risk assessment and protective action decision-making, including at the individual, group, and community levels.
- 2.3** Examine how to convey visual information more effectively and with a focus on how representations of weather hazards and their uncertainty can improve risk assessment and decision-making.



Testbed Programs

The Testbeds Program funds collaborative weather research projects that enable academic, governmental, and industry partners to work within NOAA Testbeds. NOAA Testbeds support the testing and demonstration of weather research in a quasi-operational setting, which accelerates O2R and R2O transitions. Testbeds include a wide range of projects that cross-cut all four WPO goals.

Extreme and High-Impact Weather Prediction

2.4 Improve forecasts of extreme and high-impact weather through research and multi-sector partnerships across NOAA and the Weather Enterprise:

2.4.1 Fire Weather and Atmospheric Composition: Improve predictive capabilities for fire weather, fire spread, and atmospheric composition to better inform the public during wildfire events and hazardous air pollution episodes.

2.4.2 Severe Weather: Improve severe weather forecasts and provide useful predictive information ahead of tornadic and other severe storms using high resolution, convection-allowing ensemble model forecasts.

2.4.3 Subseasonal to Seasonal Forecasts: Improve the accuracy of and pattern recognition of high-impact weather forecasts at subseasonal to seasonal timescales, including temperature and precipitation extremes.

2.4.4 Tropical Weather: Improve hurricane genesis, track, and intensity forecasts.

2.4.5 Water and Extreme Rainfall: Improve forecasts for extreme rainfall, drought, and flooding by better understanding the physical processes and sources of uncertainty that contribute to these events.

2.4.6 Winter Weather: Improve techniques for the prediction of freezing and frozen precipitation events (i.e. formation, timing, areal coverage, intensity, and amount) and associated uncertainty.

Future of Forecasting

2.5 Develop, test, and demonstrate new forecasting approaches rooted in a continually-updating, ensemble-based probabilistic database to revolutionize how forecast uncertainty and risk-based decision making is incorporated into the forecast process.

2.6 Create and evaluate probabilistic and deterministic hazard information delivery and visualization capabilities, utilizing NOAA Testbeds, to improve decision support for a diverse range of users.

2.7 Improve NOAA's capabilities to characterize, predict, and communicate impacts from extreme weather events using diverse data sources within and outside of NOAA.

Earth Prediction Innovation Center (EPIC)

EPIC facilitates innovation and accelerated research-to-operations-to-research (R2O2R) of NOAA weather forecasting systems by providing a cloud development environment, software engineering, and by fostering community engagement through workshops and tutorials.

Unified Forecast System

The Unified Forecast System (UFS) is a community-based, coupled comprehensive Earth system modeling system. The UFS numerical applications span local to global domains and predictive time scales from sub-hourly analyses to seasonal predictions. It is designed to support the Weather Enterprise and to be the source modeling system for NOAA's operational numerical weather prediction applications. (Source: [VLab – UFS](#)).



Goal 3: Contribute to the best possible Unified Forecast System through a community-based, Earth system modeling approach.

WPO is a key sponsor of community modeling within NOAA. This goal aspires to accelerate Earth system model development within a community modeling framework, for the purpose of creating the best possible operational numerical prediction system for the Nation. Through the Earth Prediction Innovation Center (EPIC), WPO enables a community of practice including OAR Laboratories, the NWS, industry, academia, and other national and international organizations to improve the Unified Forecast System (UFS) and to

help democratize operational numerical weather prediction. Combining this approach with WPO's grants competitions, we aim to facilitate the improvement of the modeling suite leading to more seamless weather-to-climate numerical weather prediction on timescales from minutes to months and on spatial scales from individual clouds to the globe. This effort also requires accelerating coupled model development, improving data assimilation across multiple scales, and expanding reforecasts and reanalyses.



William "Bill" Lapenta
Former WPO Director

Remembering Bill's Vision

WPO celebrates the life and legacy of the late William Michael Lapenta, 1961–2019

"Bill spoke endlessly to us about the need for seamless integration of the numerical modeling community across boundaries. We hope Bill's commitment continues to motivate us to invest all our energy in creating a seamless community focused on important societal challenges,"

-Russell Schneider, Former Acting WPO Director.

Community-Based Earth System Prediction

- 3.1** Accelerate coupled Earth system model development to include all components of the Earth system required to improve forecast accuracy on weather-to-seasonal scales (e.g. atmosphere, oceans, coastal, cryosphere, land, and biosphere including appropriate human components).
- 3.2** Nurture a highly inclusive and diverse modeling community of practice across the Weather Enterprise by hosting workshops, documenting and benchmarking all code releases, developing testing and training resources, and providing dedicated user support.
- 3.3** Use an open development approach to improve the accuracy and performance of NOAA's short-range and medium-range weather models through EPIC.
- 3.4** Advance and evaluate a seamless weather-to-climate forecast system to improve subseasonal to seasonal predictions at actionable scales, study modes of variability across weather and climate timescales, and better understand and predict how extremes are changing within larger climatic changes.
- 3.5** Contribute to the development of a next generation convection-allowing ensemble prediction system to improve extreme weather forecasting at the scale of individual storms, and conduct research into the physics and data assimilation configurations that maximize forecast accuracy.
- 3.6** Establish a WPO student fellowship program to develop the next generation modeling workforce.

Data Assimilation

- 3.7** Improve coupled Earth system data assimilation for weather, water, and subseasonal to seasonal forecasting, including through partnerships with the Joint Center for Satellite Data Assimilation (JCSDA).
- 3.8** Partner with National Environmental Satellite, Data, and Information Service (NESDIS) and the National Centers for Environmental Prediction (NCEP) to increase access to observations and data for numerical weather prediction.
- 3.9** Support novel research methods and new workforce development strategies for data assimilation to advance weather prediction.

Reanalyses and Reforecasts

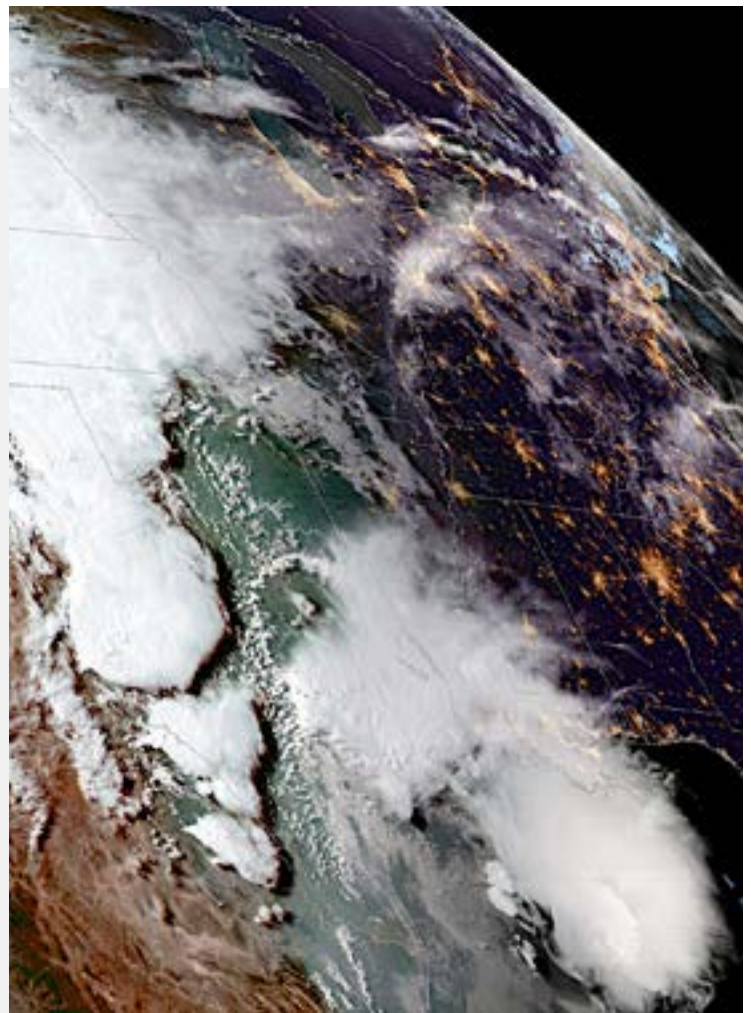
- 3.10** Advance the production and public access of reanalyses and reforecasts to improve detection and quantification of extreme events, bias correction, and forecast performance evaluation.
- 3.11** Through internal and external partnerships, contribute to a regular, sustained Earth system reforecasting activity to enable a more effective cadence and accelerated process for operational model improvements.

Earth System

The Earth system encompasses the atmosphere and its chemical composition, the oceans, land/sea ice and other cryosphere components as well as the land surface, including surface hydrology and wetlands, lakes, and human activities. On short time scales, it includes phenomena that result from the interaction between one or more components, such as ocean waves and storm surges. On longer time scales (e.g., climate), the terrestrial and ocean ecosystems, including the carbon and nitrogen cycles and slowly varying cryosphere components (e.g., the large continental ice sheets and permafrost), are also part of the Earth system (Source: [Shapiro et al., 2010; BAMS](#)).

Ensemble Models and Forecasts

Ensemble models and forecasts are comprised of multiple predictions from an ensemble of slightly different initial conditions and/or various versions of models. The objective of ensemble models are to improve the accuracy of the forecast through averaging the various forecasts (which eliminates non-predictable components), and to provide reliable information on forecast uncertainties from the diversity amongst ensemble members. Forecasters use this tool to measure the likelihood of a forecast (Source: [NWS Glossary](#)).



Goal 4: Strengthen the mission-enabling, foundational infrastructure for next-generation weather research and transitions.

Investment in infrastructure that supports research and transitions is foundational to the success of goals one to three. Goal one describes the human effort required to advance a weather research and development network across the Weather Enterprise, while goal four describes the underpinning technological, engineering, and process management effort needed to realize the full benefits of the research

projects funded by WPO. This includes targeted research and development in next-generation observing systems and computing capabilities, new approaches using artificial intelligence, and advancements in data access and archival. As part of this goal, WPO will continue to improve on its tradition as a leader in transitioning research to operations and applications to ensure that research is applied for the benefit of society.

Mission Underpinnings

- Observations
- Physical and social science data infrastructure
- Enhanced high performance computing
- Cloud-based development systems mirroring operations
- Accelerated transitions
- Artificial intelligence and machine learning (AI/ML)



Observations and Observing Systems

- 4.1** Advance the innovation, use, and assimilation of ground based, airborne, marine, and satellite observations that support Earth System model performance and that achieves a mission-effective, integrated, and adaptable observing system portfolio for NOAA.
- 4.2** Research and analyze new and emerging observational capabilities including modern radar technologies, smaller/cost-effective systems to fill observing gaps, and technologies to improve the understanding and prediction of the atmospheric boundary layer and associated land-sea-air fluxes.
- 4.3** Identify the impact of various observing systems on prediction skill and the quality of forecast products through investments in sensitivity studies, observing system experiments, and observing system simulation experiments.

Computing Capability and System Architecture

- 4.4** Develop a publicly accessible end-to-end testing and development environment in the cloud for NOAA's core medium and short-term UFS weather models through EPIC.
- 4.5** In partnership with the NOAA Office of the Chief Information Officer (CIO), research modeling systems that effectively use emerging high-performance computing architectures to keep pace with technological advances and explore mechanisms to develop the NOAA workforce needed for these future architectures.

Artificial Intelligence and Machine Learning

- 4.6** Build interdisciplinary research partnerships to leverage innovative approaches in AI/ML in the areas of pre-processing and data aggregation, hybrid numerical weather prediction, and social science.
- 4.7** Apply AI/ML to develop more computationally efficient approaches to represent physics and other model processes including parameterizations.
- 4.8** Increase the speed, accuracy, and reliability of forecasts through application of AI/ML to model post-processing.

Physical and Social Science Data Infrastructure, Access, and Archiving

- 4.9** Research and identify advances in information access and archiving to improve ease of public access to data, research outputs and outcomes, and virtual experimentation.
- 4.10** Build capacity to collect and analyze quantitative and qualitative baseline, longitudinal, and event-specific social, behavioral, and economic data to learn what weather information is needed when, by whom, and how it can and will be used.

Transitions

- 4.11** Accelerate the transition of research to operations, applications, and commercialization through Weather Enterprise collaboration, rapid prototyping, early identification of operational requirements, and innovative/flexible transition mechanisms to streamline the end-to-end process.
- 4.12** Leverage NOAA Testbeds to facilitate research to operations transitions and to co-develop new products, services, and tools with end users.

PARTNERSHIPS

WPO is committed to strengthening and expanding its partnerships. WPO relies on the support, engagement, and commitment of its trusted and valued partners to develop and transition products and services that provide accurate and actionable weather information for all. Each partner across

the Weather Enterprise brings to bear unique skills, capabilities, and opportunities to advance weather research, products, and services. These potential areas of partnership are broadly outlined in the table below.

Partners	Goal 1	Goal 2	Goal 3	Goal 4
Academia	<ul style="list-style-type: none"> - Understand future research directions to inform funding opportunities - Multi-university research consortia to address critical NOAA science priorities 	<ul style="list-style-type: none"> - Advanced physics algorithms and parameterizations across phenomena - Next-generation forecast processes, tools and techniques - Understanding of user needs via social science surveys and assessments 	<ul style="list-style-type: none"> - Experiments, testing, and improvements to NOAA models - Exploring innovative data assimilation methods - Training next generation modelers through open source code and tutorials 	<ul style="list-style-type: none"> - Research advanced AI/ML techniques - Sensitivity studies of observational systems to NOAA forecasts
Industry	<ul style="list-style-type: none"> - MOUs, CRADAs and other public private partnerships that benefit all parties 	<ul style="list-style-type: none"> - New ways to visualize and disseminate forecasts to a broad range of populations - Products that combine NOAA weather information with sector- and user-specific information 	<ul style="list-style-type: none"> - Community modeling advancements that contribute to open source code over time 	<ul style="list-style-type: none"> - Innovative observational systems to address key observing gaps - AI/ML to improve high resolution, user-specific forecasts - Transition of NOAA research to applications
NOAA (OAR, NWS, NESDIS, NOS, OMAO, NMFS)	<ul style="list-style-type: none"> - Development of multi-disciplinary, longer term shared priority research initiatives and joint funding opportunities - Collaboration on culture, diversity, and workforce development initiatives 	<ul style="list-style-type: none"> - Extensive partnership with OAR Labs and NWS to improve forecasts across hazards 	<ul style="list-style-type: none"> - Development of an Earth system modeling framework across NOAA - Development of a convection-allowing ensemble prediction system 	<ul style="list-style-type: none"> - Planning and evaluation for R20 transitions - Collaboration across NOAA on observing and computing infrastructure
Other Agencies and Non-profit Organizations	<ul style="list-style-type: none"> - Incorporating research and information from other agencies into NOAA products and services 	<ul style="list-style-type: none"> - Rapid social science surveys and assessments after extreme events - Partnerships that improve equity of weather, water, and climate products and services 	<ul style="list-style-type: none"> - Partnerships with NSF to expand grants to use NOAA open source models - Global, sustained, Earth system reanalysis and reforecasting capabilities 	<ul style="list-style-type: none"> - Providing NOAA research and data in usable formats to inform public policy - Workforce development - Emerging high performance computing

STRATEGIC PLAN DEVELOPMENT

FINAL STRATEGIC PLAN

OAR Revisions
.....

Employee
Revisions
.....

Leadership
Revisions
.....

Initial Draft
.....

Related Plans,
Reports & Documents
.....

Stakeholder
Interviews
.....

Employee
Workshops
.....

FOUNDATIONS

Stakeholders and employees are the foundation of the new WPO Strategic Plan. The initial draft was developed based on an analysis of stakeholder plans and reports, over 50 internal and external stakeholder interviews and survey responses, and multiple employee workshops and brainstorming sessions. The draft was then refined by WPO Leadership, employee feedback, and final OAR review. The core values, which are central to WPO and this strategic plan, were developed using a grassroots approach with participation from all WPO staff.

CORE MOTIVATING DOCUMENTS

Core documents served as the outline and framework for the new WPO Strategic Plan, including the Weather Research Forecasting Innovation Act 2017, the Science Advisory Board (SAB) Priorities for Weather Research (PWR) Report, the NOAA 2022–2026 Strategic Plan, and the OAR Strategy 2020–2026. These high-level documents detailed the legal mandates, Agency and Line Office priorities, and research

frameworks that drive WPO's mission and integrate its efforts into broader national and Weather Enterprise goals. Throughout this plan, we have included elements of the OAR Strategic Plan goal of "Making Forecasts Better: Improve accuracy, precision, and efficiency of forecasts and predictions to save lives and property and support a vibrant economy."

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The three objectives within this OAR goal are listed below, as well as how they are incorporated into the WPO Strategic Plan.

- Develop interdisciplinary Earth system models: This objective is core to Goal Three.
- Design tools and processes to forecast high-impact weather, water, climate, ocean, and ecosystem events: This objective is core to Goal Two.

- Transition science that meets users' current and future needs: While transitions are explicitly mentioned in Goal Four, the weather research and development network described in Goal One and the social science research and application in Goal Two are critical to being able to transition science that meets user needs.

Items championed by WPO in the OAR Strategic Implementation Plan have also been woven through this strategic plan as shown in the table below.

Outcome	Performance Measure
Reduce developmental time from research to operations through adoption of community-based Earth system modeling.	Cumulative number of forecast and mission improvements* to weather applications (achieve RL8) at operational US weather services and in the US weather commercial sector. *Based on The Weather Research and Forecasting Innovation Act of 2017
Enhance the value of tornado forecasts by transitioning social science projects into application.	Cumulative number of R2X projects that include social science research and methods to address forecaster and end user needs to prepare for and respond to/ minimize societal impact for extreme weather events.

The 2021 Science Advisory Board (SAB) Priorities for Weather Research (PWR) Report was particularly integral to plan development. The report, requested by Congress, is NOAA-focused within the broader context of the Weather Enterprise and the needs of society. It is the result of a collaborative effort that included input from

more than 150 subject matter experts and NOAA Senior Leadership. The following table maps specific WPO Strategic Plan goals and objectives to priority area recommendations made in the SAB PWR Report. In total, this WPO Strategic Plan contains goals and objectives that align with 25 of the 33 priority areas from the report.

WPO Goals & Objectives	SAB PWR Report Recommendations
Goal 1	Foundational Element-1
1.1	Information Delivery-1
1.4	Information Delivery-1
1.7.2	Foundational Element-5
1.11	Immediate Priority-10
2.2	Information Delivery-4
2.3	Information Delivery-4.2
2.4	Forecasting-6
2.4.1	Forecasting-5
2.4.5	Forecasting-4, Observations & Data Assimilation-8
2.6	Information Delivery-5
Goal 3	Forecasting-2, Foundational Element-4
3.1	Forecasting-1

WPO Goals & Objectives	SAB PWR Report Recommendations
3.5	Foundational Element-2
3.6	Foundational Element-8
3.7	Observations & Data Assimilation-4
3.9	Observations & Data Assimilation-3
3.10	Observations & Data Assimilation-5
3.11	Forecasting-3
4.1	Observations & Data Assimilation-1&2
4.2	Observations & Data Assimilation-6&9
4.5	Forecasting-5
4.6	Foundational Element-3
4.10	Information Delivery-6

The NOAA 2022–2026 Climate-Ready Nation Strategic Plan: The 2022–2026 WPO Strategic Plan aligns very well with NOAA’s Climate-Ready Nation Strategic Plan. Our plan puts equity and partnerships central to WPO’s mission, similar to NOAA, and threads these key concepts across multiple goals and objectives. Furthermore,

research that results in better minutes-to-months forecasts and decision support is an important form of climate change adaptation, and thus is critical to achieving NOAA’s Goal 1 of Building a Climate-Ready Nation. The four WPO Strategic Goals map into several NOAA strategic objectives and sub objectives, as shown in the table below.

WPO Strategic Goals	NOAA Climate Ready Nation Strategic Objectives
Goal 1	2.1.2: Deepen Workforce Equity and Belonging 2.1.3: Diversify NOAA STEM Fields and Enhance Partnership with Minority-serving Institutions 2.2.4: Develop New Community Engagement Approaches 2.2.5: Strengthen Social Science and Evaluation Capacity
Goal 2	1.2.2: Build Out Sub seasonal to Annual Integrated Water Capabilities 1.3.2: Strengthen Capacity for Social Science Research 2.2.3: Design Easy-to-Use Tools and Services
Goal 3	1.2.1: Improve Weather, Water, and Climate Predictions and Projections 1.2.2: Build Out Sub-seasonal to Annual Integrated Water Capabilities 1.3.1: Mature World-Class Next-Generation Earth System Models
Goal 4	1.3.2: Strengthen Capacity For Social Science Research 1.3.3: Advance Cutting-Edge Integrated Research to Operations 1.4.3: Improve Enterprise-Level Data Management 2.2.5: Strengthen Social Science and Evaluation Capacity

Over the coming year, WPO will develop a brief implementation plan that will serve as a roadmap for the office to reach our goals and objectives. The

plan will also contain indicators of success and performance metrics to ensure the organization is making progress towards our stated strategies.

ACRONYMS

Acronym	Definition
AI/ML	Artificial Intelligence/Machine Learning
CIO	Office of the Chief Information Officer
CRADA	Cooperative Research and Development Agreements
EPIC	Earth Prediction Innovation Center
JCSDA	Joint Center for Satellite Data Assimilation
MOU	Memoranda of Understanding
NCEP	National Centers for Environmental Prediction
NESDIS	National Environmental Satellite, Data, and Information Service
NOAA	National Oceanic and Atmospheric Administration

Acronym	Definition
NWS	National Weather Service
O2R	Operations to Research
OAR	Oceanic and Atmospheric Research (also referred to as NOAA Research)
PMA	Presidential Management Agenda
PWR	Priorities for Weather Research
R2O	Research to Operations
SAB	Science Advisory Board
UFS	Unified Forecast System

ALL DOCUMENTS & SOURCES

The following inputs served as inspiration and building blocks for the new WPO Strategic Plan:

Related plans, reports, and other documents:

- Weather Research Forecasting Innovation Act 2017
- NOAA Research and Development Vision Areas 2020–2026
- NOAA Science Advisory Board / Environmental Services Working Group Priorities for Weather Research 2021
- OAR Strategy 2020–2026
- OAR Implementation Plan 2021–2026
- DOC Strategic Plan 2022–2026
- NOAA's FY23–FY27 Weather Water Climate Strategy
- NOAA's FY22–FY26 Strategic Plan
- NWS Weather Ready Nation Strategic Plan 2019–2022
- EPIC Strategic Plan 2021
- WPO Pulse Survey (February 2021)
- WPO Organizational Health and Culture Assessment (June 2020)
- WPO SWOT Analysis (July 2021)
- President's Management Agenda Learning Agenda

External scientist surveys:

- Texas Tech University
- Nurture Nature Center
- University of Oklahoma
- Colorado State University
- Cooperative Institute for Severe and High-Impact Weather Research and Operations
- University at Albany, SUNY
- Stony Brook University

Internal NOAA stakeholder interviews and surveys:

- NOS - Center for Operational Oceanographic Products and Services
- NWS - Climate Prediction Center
- NWS - Environmental Modeling Center
- NWS - National Centers for Environmental Prediction
- NWS - Office of Central Processing
- NWS - Office of Dissemination
- NWS - Office of Observations
- NWS - Office of Organizational Excellence
- NWS - Office of Science and Technology Integration
- NWS - Weather Prediction Center
- OAR - Air Resources Laboratory
- OAR - Atlantic Oceanographic and Meteorological Laboratory
- OAR - Chemical Sciences Laboratory
- OAR - Climate Program Office
- OAR - Geophysical Fluid Dynamics Laboratory
- OAR - Global Ocean Monitoring and Observing
- OAR - Global Systems Laboratory
- OAR - National Severe Storms Laboratory
- OAR - Ocean Acidification Program
- OAR - Office of Research Transition and Application
- OAR - Office Policy and Congressional Affairs
- OAR - Sea Grant
- OAR - Testbeds